Clean Air Progress in Maryland

Accomplishments 2012

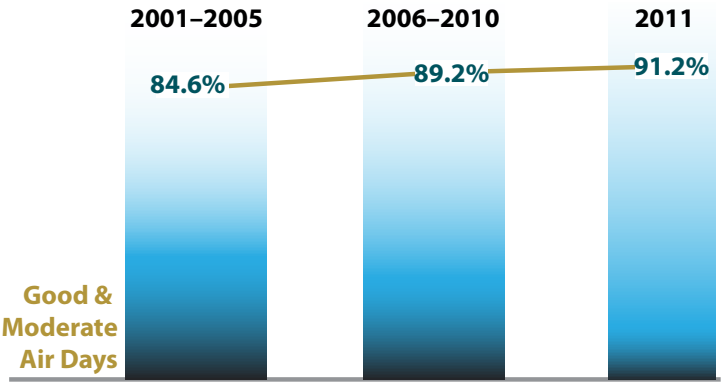


Maryland's Air

For nearly forty years, Maryland has worked to improve air quality. Thanks to the sustained efforts of the Maryland Department of the Environment (MDE), businesses, concerned citizens, scientists, health professionals and many others, Maryland and surrounding states have seen dramatic improvements in air quality. These improvements have direct implications for public health, our quality of life and the economy.

Reductions in emissions from utilities, motor vehicles and other sources as diverse as manufacturing and consumer products have reduced the number of days on which Marylanders breathe unhealthy air. The reductions have also improved visibility. These improvements are the direct result of effective controls on local sources of air pollution. By requiring installation of state of the art control technologies and aggressive policies, we continue to progress toward cleaner air.

Air Quality Days in Maryland



The chart illustrates Maryland's sustained air quality improvements over the past decade. The percentage of Good and Moderate days have increased steadily while the percentage of Bad air days continues to decline. In 2011, over 91% of the days were Good or Moderate. To monitor this progress, follow MDE's Quality of Air monthly reports.

Inside

The mission of the Maryland Department of the Environment is to protect and restore the quality of Maryland's air, water and land resources, while fostering smart growth, a thriving and sustainable economy and healthy communities.

Criteria Pollutants

New Ozone Standard & Designation

In May 2012, EPA is expected to finalize the boundary designations for the new 75 ppb 8-hour ozone standard. Despite the progress that has been made in reducing ground level ozone, parts of Maryland continue to record some of the highest ozone levels in the east. These monitors are subject to the "perfect storm" for ozone air pollution, where unique meteorology and geography line up with transported pollution from power plants in the west and local pollution from the south, primarily cars and trucks along the I-95 corridor. This pollution is literally trapped along the western edge of the Bay by the unique winds, called the Bay breeze.

To address this continuing problem in Maryland, MDE is supporting, both technically and legally, EPA's efforts to reduce transported air pollution from power plants and mobile sources. MDE is also considering other legal options in the Clean Air Act to compel emission reductions in upwind states. MDE has also proposed a new local regulation designed to further reduce emissions from mobile sources in both the Baltimore and Washington DC areas.

National Ambient Air Quality Standards (NAAQS)

The *Clean Air Act* requires the Environmental Protection Agenc (EPA) to set National Ambient Air Quality Standards (40 CFR Part 50) for pollutants considered harmful to public health and the environment. EPA must designate areas as meeting (attainment) or not meeting (nonattainment) the NAAQS. The *Clean Air Act* requires states to develop a general plan to attain and maintain the NAAQS and specific plans to attain the standards for each area designated nonattainment. These plans, known as State Implementation Plans or SIPs, are prepared by state and local air quality management agencies and submitted to EPA for approval. Currently, parts of Maryland are designated as nonattainment. There are persistent problems largely caused by emissions generated in upwind states.

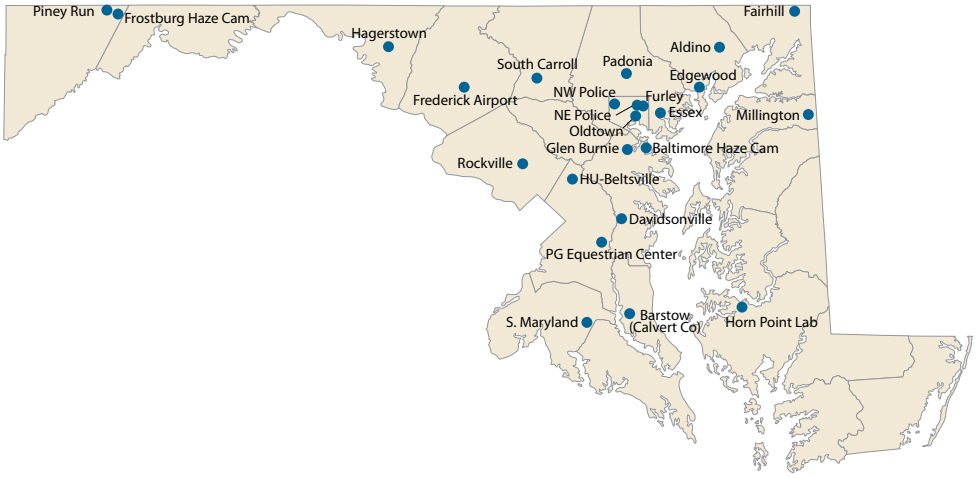
Six Common Pollutants

The EPA has established health-based standards for six commonly found air pollutants. These pollutants, found throughout the United States, are particle pollution (often referred to as particulate matter or PM), ground-level ozone, carbon monoxide, sulfur dioxide, nitrogen dioxide and lead. These pollutants can harm your health, the environment and property. EPA calls these pollutants "criteria" air pollutants because it regulates them by developing human health-based and/or environmentally-based criteria (science-based guidelines) for setting permissible levels. Of the six pollutants, ozone and particle pollution are the cause of the most significant health threats in Maryland.

Monitoring Air Pollution in Maryland

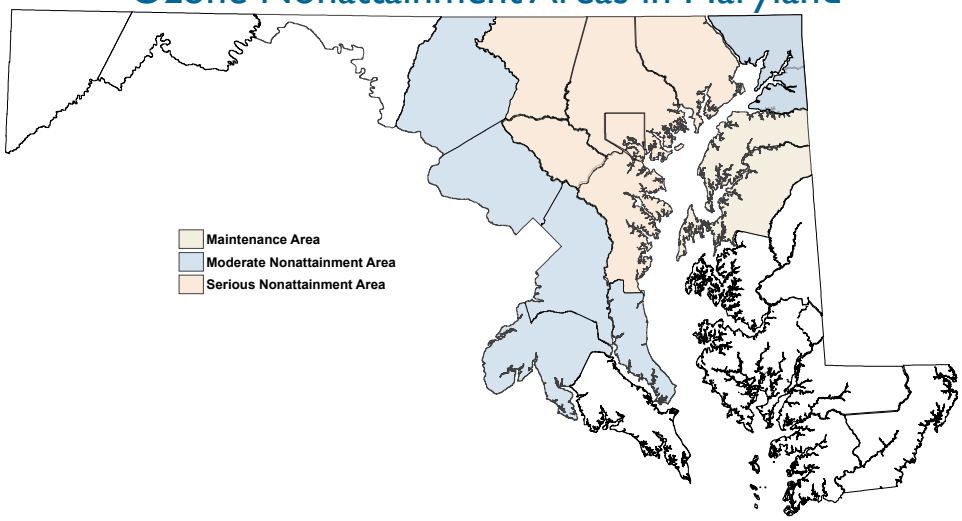
Maryland currently operates 23 air monitoring stations and two haze cams around the State. These measure ground-level concentrations of criteria pollutants and air toxics. They also take meteorological and other research–oriented measurements. Although monitoring takes place Statewide, most of the stations are concentrated in the urban/industrial areas, which have the highest population and number of pollutant sources. This network is maintained and operated by the Ambient Air Monitoring Program of MDE's Air and Radiation Management Administration.

Maryland Air Monitoring Sites



Ozone

Ozone Nonattainment Areas in Maryland

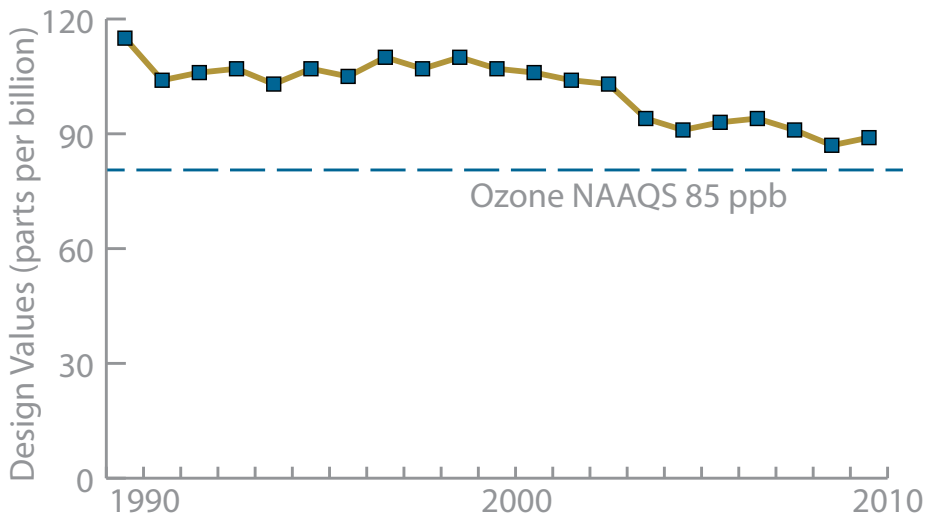


Ozone NAAQS	
Final Rule	62 FR 38856 Jul 18, 1997
Averaging Time	8-hour
Level	85 parts per billion

EPA adopted a more stringent ozone NAAQS – 75 parts per billion – on March 27, 2008 (71 FR 61144). It is anticipated that revisions to the State Implementation Plans will be due in 2015.

It is unlikely that Maryland will achieve the NAAQS for ozone unless federal policies are implemented to address the impacts of transported pollution.

8-Hour Ozone



The State of Maryland has been very aggressive in controlling pollution that is generated within the State's borders. Maryland was one of the first states to implement the NO_x RACT (1995), NO_x Budget Programs (2000) and the NO_x SIP Call (2003) which are viewed as wholesale successes in air pollution control. Most of Maryland's point sources that emit more that 25 tons per year of NO_x are controlled by regulations.

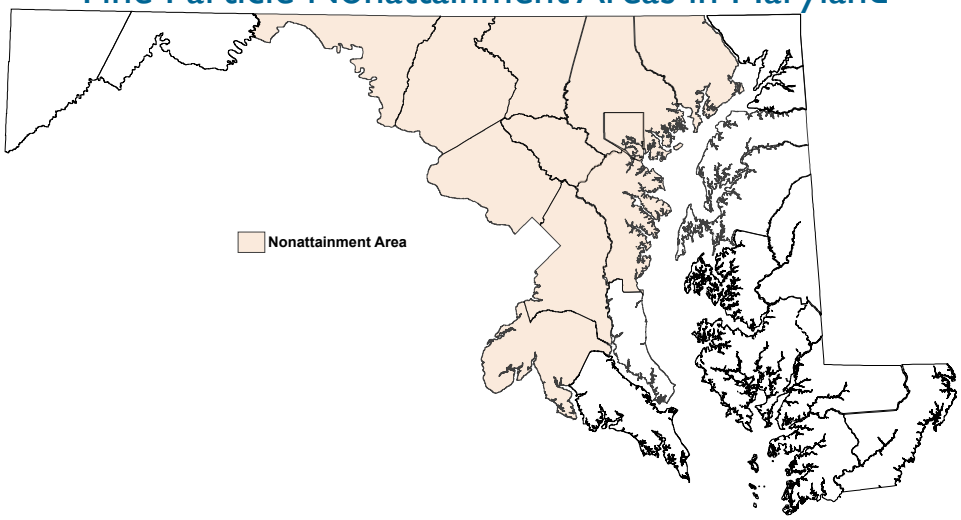
Numerous regulations to control NO_x and VOCs from sources as diverse as consumer products, industry, electricity generation and fuels have been adopted in Maryland. Effective local controls are working to reduce ozone pollution, but robust regional and national programs are needed to support Maryland's efforts.

Resources

Maryland's State Implementation Plans
Maryland's Air Monitoring Network
National Ambient Air Quality Standards
Six Common Air Pollutants

Fine Particles

Fine Particle Nonattainment Areas in Maryland

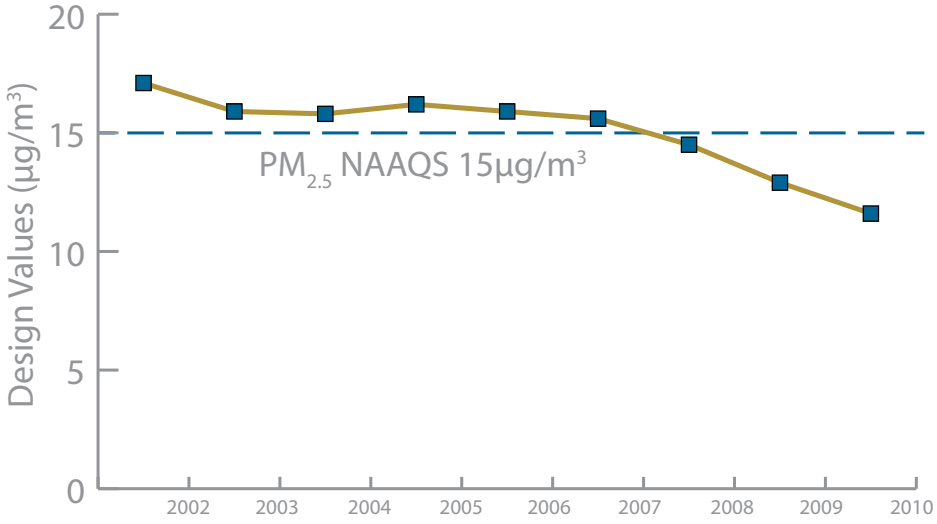


Fine Particle NAAQS	
Final Rule	71 FR 61144, Oct 17, 2006
Averaging Time	Annual Daily (24-hour)
Level	Annual 15 µg/m³ Daily 35 µg/m³

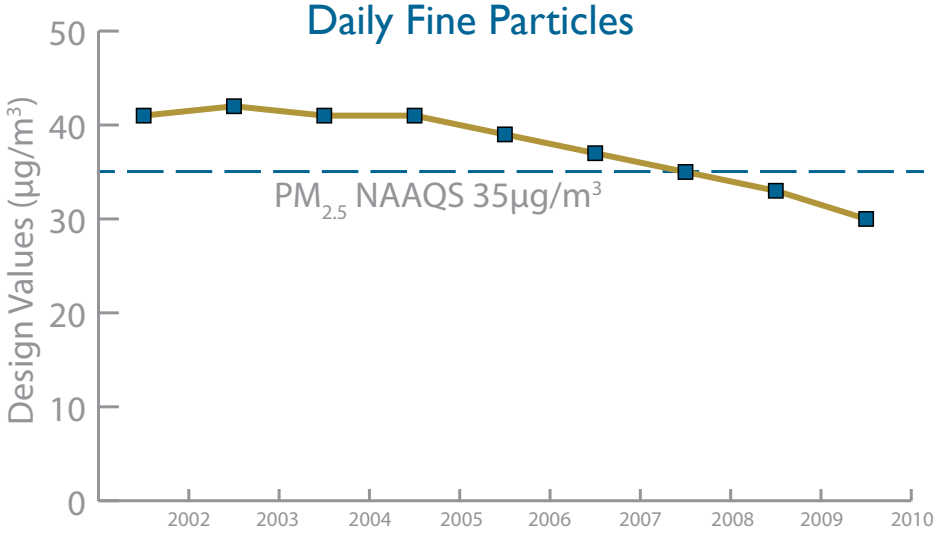
Fine particles are composed of nitrogen and or sulfur compounds combined with other organic or inorganic compounds. The size of particles plays an important role in how they affect human health. Particles also degrade visibility.

Maryland is currently measuring levels below the standards across the State.

Annual Fine Particles



Daily Fine Particles



Annual and daily standards are designed to protect people from long-and short-term effects of exposure to particle pollution.

Particle pollution is declining in Maryland because of regulations that decrease nitrogen oxides and sulfur dioxide emitted to the air. Major sources of these pollutants include electricity generating units and diesel fuel burning vehicles.

Maryland is addressing the problem of particle pollution through the Healthy Air Act, the Diesel Vehicle Inspection Program and other regulations aimed at reducing sulfur dioxide and nitrogen oxides from cement plants, mining operations and paper mills.

Toxic Air Pollutants

Progress in Reducing Toxic Air Pollution

Maryland has made considerable progress in reducing exposure to other air pollutants, commonly called non-criteria pollutants or toxic air pollutants. Examples of toxic air pollutants include benzene (a constituent in motor fuels and used as a solvent), acetaldehyde (used in the production of perfumes, polyester resins and basic dyes) and toluene (used as a solvent and in the production of common consumer products). Concentrations of all three of these air toxics have been cut nearly in half over the past ten years.

Although our understanding of the specific public health benefits associated with any particular pollutant reduction measure is not complete, there is a sufficient body of knowledge to conclude that programs designed to reduce air toxics have a positive effect on the environment and public health. Programs designed to reduce the amount of diesel smoke fit within this category. Maryland is making progress in reducing diesel emissions to reduce cancer risks from air toxics and to make progress toward attainment with the fine particle NAAQS.

Mobile Sources – Diesel Emissions Reduction Programs

Maryland has received nearly $3,200,000 in non-state funding to retrofit locally-operated diesel school buses with pollution control equipment to reduce diesel particles. Other efforts to reduce diesel emissions include:

- Cummins, a major manufacturer of diesel engines, entered into an agreement with EPA to install diesel emission controls on transit buses operated by the Maryland Transit Administration (MTA).
- MDE has worked with local jurisdictions to reduce diesel emissions from heavy equipment, including trash trucks, dump trucks and fire trucks. Baltimore City, Montgomery and Howard Counties have worked with MDE to retrofit diesel vehicles in a number of targeted diesel emissions reduction programs.
- The Maryland Port Administration, by retrofitting diesel engines, is reducing emissions from cargo-handling equipment, tug boats, drayage trucks and locomotives serving the port and surrounding communities.
- MDE continues to work with local and federal partners to secure and disperse funding to mitigate air toxics and particle pollution from diesel vehicles.

Healthy Air Act

A Success Story

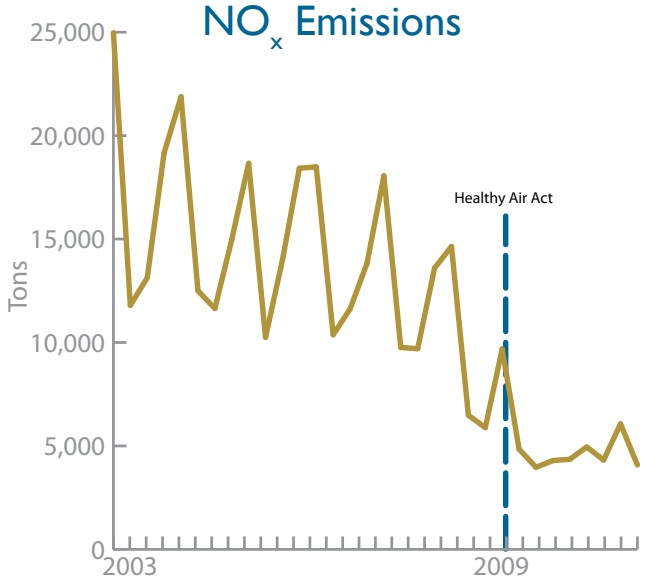
Constellation Energy undertook a multi-year air quality control system project to coincide with the new regulatory requirements from the Maryland Healthy Air Act. At more than 1,300 megawatts of capacity, the Brandon Shores project represents one of the largest air quality control retrofits in the United States.

The goals of this retrofit project were to remove up to 95 percent of the sulfur dioxide emissions and 90 percent of the mercury emissions. The technology includes both hydrated lime injection for sulfur dioxide control and powdered activated carbon injection for mercury control as well as pulse jet fabric filters for particle control. A wet flue gas desulfurization system diverts flue gases from old chimneys to a new 400 foot high wet chimney.

Maryland utilities have invested approximately $2.6 billion in pollution controls to meet the requirements of the Healthy Air Act.

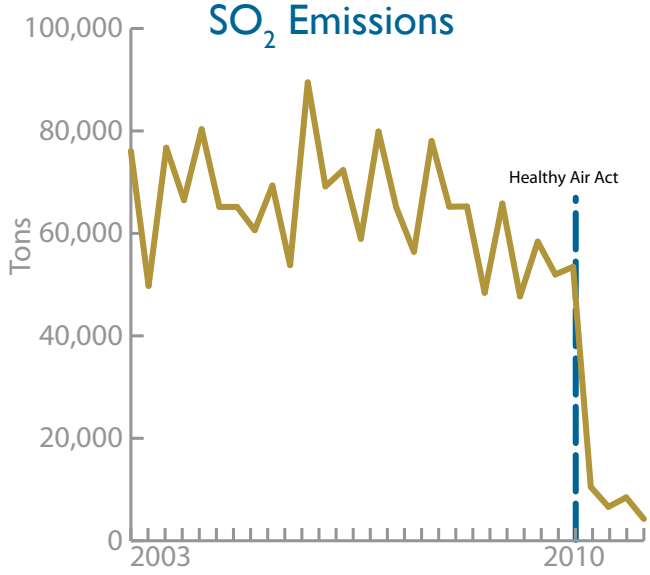
The Maryland *Healthy Air Act*, adopted by the Maryland General Assembly in 2006, is the toughest power plant emission law on the East Coast. Designed to bring Maryland into compliance with NAAQS for ozone and fine particles, the *Healthy Air Act* requires reductions in nitrogen oxides (NO_x) and sulfur dioxide (SO_2). The Act also requires control of mercury emissions and greenhouse gases (GHGs). The emissions reductions from the *Healthy Air Act* come in two phases. The first phase required reductions in the 2009-2010 time frame and, compared to a 2002 emissions baseline, reduced NO_x emissions by almost 70 percent and SO_2 emissions by 80 percent. The Act required 80 percent control of mercury emissions by 2010.

The second phase of emissions controls occurs in the 2010-2013 time frame. At full implementation, the *Healthy Air Act* will reduce NO_x emissions by about 75 percent and SO_2 emissions by about 85 percent from the 2002 baseline. Ninety percent of mercury emissions are to be controlled by 2013.



Before the Healthy Air Act was adopted, there was seasonal variation in the emissions because controls were used during the summertime ozone season but not during the cooler months.

NO_x emissions, a major component of particle pollution and an ozone precursor, have been reduced by 70 percent from pre-Healthy Air Act levels.



Before the Healthy Air Act was adopted, there were no controls in place for SO_2.

With the Healthy Air Act in place, SO_2 emissions, a major component of particle pollution, have been reduced by 89 percent from pre-Healthy Air Act levels.

Clean Cars

The *Maryland Clean Cars Program*, enacted by the Maryland General Assembly in 2007, adopts California's stricter vehicle emission standards. These new car standards became effective in Maryland for model year 2011 vehicles, significantly reducing a number of emissions including volatile organic compounds (VOCs), NO_x and GHGs. The VOC reduction achieved from this program in 2020 is expected to be 3.4 tons per day greater than reductions from the existing federal standards and the NO_x reduction is expected to be 2.9 tons per day greater than reductions from the existing federal Tier 2 standards that were in place at the time of the program's enactment. The *Maryland Clean Cars Program* is expected to reduce GHG emissions by up to 30 percent.

By adopting California's standards, Maryland joined other states committed to further reducing pollution from motor vehicles. On May 19, 2009, President Obama announced new GHG and fuel economy standards for passenger vehicles that were set through a joint rule-making process by the EPA and the National Highway Traffic Safety Administration. This action brings the federal standards and California standards into harmony, effectively creating one national standard. These new standards are being phased in beginning in model year 2012. When fully implemented in model year 2016, the federal standards will attain the same fuel economy and reductions in GHG emissions as the California program.

While the new national program does effectively match the California program for new car emissions standards, enactment of the California program provides some key benefits to Maryland. First, the California program has a zero emission vehicle (ZEV) requirement. This requires the auto manufacturers to provide an increasing percentage of ZEVs for the states in the California program. Vehicles that can count towards this ZEV requirement are plug-in hybrids, electric vehicles and fuel cell vehicles. By remaining in the California Program, Maryland has guaranteed that it will be the early recipient of these new advanced technology vehicles. The second benefit will be the option to adopt tighter standards beginning in model year 2015. California has begun work on developing its next phase of emission standards. This new California program, scheduled to take effect in model years 2015-2025, will address criteria pollutants like VOCs and NO_x, and GHGs.

By adopting more stringent standards, initially the California standards followed by the 2012 federal standards, significant reductions in local and regional emissions will be achieved.

Clean Cars for Clean Air

The Clean Cars Program is the first program to directly regulate carbon dioxide (CO_2) emissions from motor vehicles. Transportation is the fastest-growing source of CO_2 in the U.S. and CO_2 is the most abundant GHG. In Maryland, approximately one third of CO_2 emissions are emitted from vehicles.

In addition to regulating GHGs from passenger vehicles, the Clean Cars Program includes a ZEV mandate that car manufacturers must meet. These vehicles produce zero or near–zero tailpipe emissions and will reduce pollutants and dependence on foreign oil.

EPA estimates that consumers who purchase a 2016 model year vehicle will see immediate savings and potentially more than $3,000 in fuel costs over the lifetime of the vehicle.

Transported Air Pollution

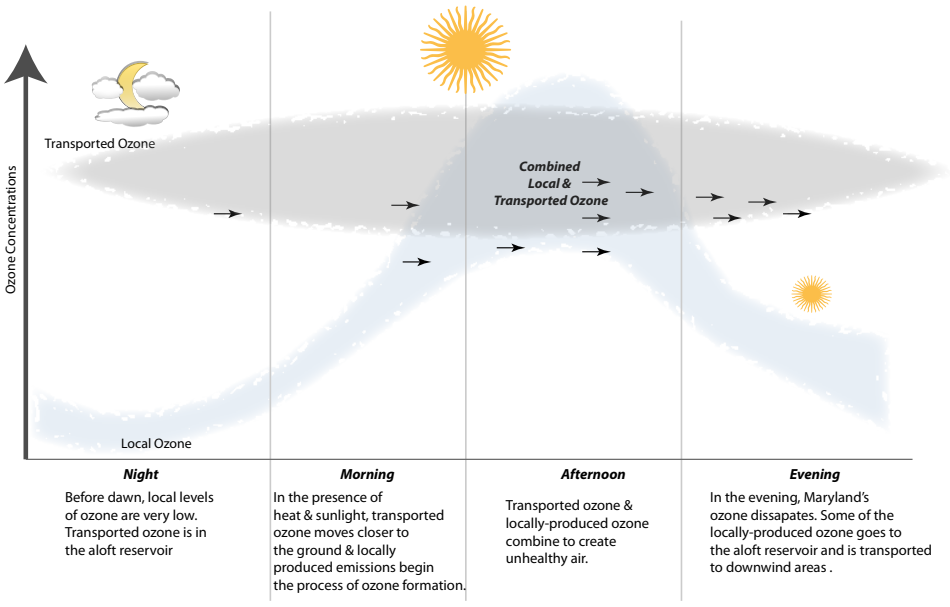
Transported Pollution

Transported pollution is the top contributor to Maryland's ground-level ozone problem. Extensive scientific research conducted over the past 20 years confirms the existence of an aloft ozone reservoir in which ozone and its precursors are formed and freely transported in the middle of the night. This elevated reservoir is trapped at about 2,000 feet above the earth's surface by a nocturnal inversion and can be pushed by elevated nighttime winds for hundreds of miles in a single night. Maryland has data from airplanes, balloons, mountaintop monitors, wind profilers and other measuring equipment that support these conclusions. Our monitors show that as the nocturnal inversion begins to break up in the morning, the aloft ozone, routinely measured at levels above 75 parts per billion (ppb), slowly mixes down to earth. The elevated reservoir is created by emissions from nearby, upwind states.

We also have empirical evidence of emissions transported by the nocturnal low level jet (NLLJ). This is a strong southwest wind along the eastern side of the Appalachian Mountains that is measured at about 2,000 feet above ground level where much less windy conditions are found. The NLLJ begins at sundown and can last until dawn. It can start as far south as North Carolina and can reach as far north as New Jersey, Connecticut and Massachusetts. Given an average speed of 30 mph, a NLLJ that runs for seven hours carries gases and particulates 210 miles. Data collected simultaneously from wind profilers and ozonesondes (a balloon-borne ozone measuring instrument) has revealed that ozone is transported via the NLLJ. Use of LIDAR (Light Detection and Ranging) remote sensing data reveals similar transport patterns for particles.

Transport becomes central to attainment in more and more states with each reduction in the NAAQS. Specifically, with each reduction in the NAAQS, the proportion of the NAAQS represented by transported pollution in these states increases. Meteorologists and atmospheric chemistry researchers at Howard University, the University of Maryland, and other institutions have documented the impact that meteorological and air transport processes, such as the NLLJ, and the elevated ozone reservoir have on local pollution levels.

Chemical lifetimes are longer and transport faster in the lower free troposphere (the boundary area between the portion of the atmosphere closest to the earth's surface, and the stratosphere above the troposhpere) than at the earth's surface and, as a result, ozone and ozone precursors are commonly carried hundreds of miles from their sources. Following transport, air in the lower free troposphere mixes down to the surface as the nocturnal inversion breaks down due to solar heating in the mornings of ozone exceedance days. The relevant mixing layer for pollutants can vary in depth during a 24-hour period from less than about 350 feet at night to more than 3,000 feet on a warm and sunny day.

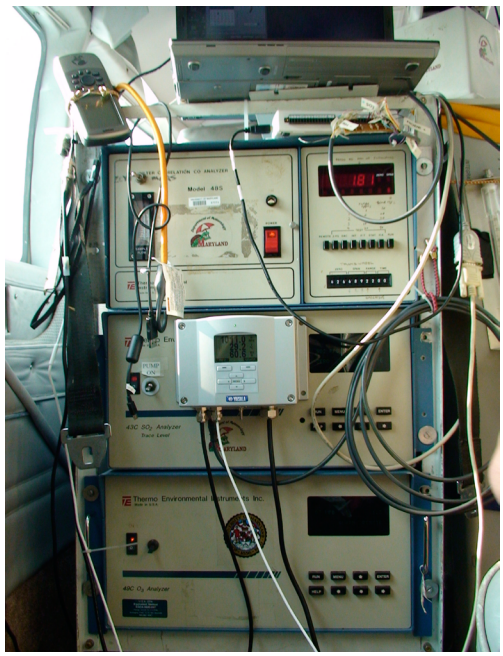


The Science

Scientific Evidence

There is an extensive body of scientific findings proving that regional transport plays a significant role in urban high ozone episodes in Maryland. More than 15 years of aircraft measurements by the University of Maryland have proven that aloft air coming into Maryland contains elevated ozone concentrations. This ozone is formed from emissions originating from sources in nearby states including Ohio, West Virginia, Pennsylvania and Virginia. Each of these states contributes substantially to Maryland's air quality problems. When this transported pollution mixes with local emission and settles close to the ground, Maryland experiences an ozone exceedence day.

Scientific observations lead us to conclude that the solution to Maryland's ozone problem may only be found in efforts to address transported pollution on regional levels. **Our data supports the statement that approximately 70% of the ozone measured in Maryland originates beyond Maryland's borders.** By continuing to implement effective local controls in combination with federal and regional efforts, Maryland will continue to improve its air quality.



DISCOVER-AQ: A Focus on Air Quality

In July 2011, a team of NASA and partner organization scientists flew in and around the Baltimore–Washington area taking detailed measurements of air pollution. The on-going mission, DISCOVER-AQ, is taking a closer look at the air quality near the surface of the Earth and helping us better understand the ingredients of the air we breathe. MDE's Air Monitoring Program supported the team conducting this innovative research.

Conclusion & Resources



Conclusion

We have effective air pollution controls in place to address the pollution we generate in Maryland. Vehicles and fuels are cleaner. Utilities have invested billions of dollars in pollution controls. We have reduced toxics emissions from fuels, paints and industrial processes. There is still work to be done to meet our air quality goals.

The science informs us that the solutions to our air problems exist within and beyond our borders. Pollution that originates in the South and Midwest is carried to Maryland and beyond by winds that transport pollution between cities, over mountains and along the Chesapeake Bay. Our research indicates that states upwind of Maryland are responsible for about 70 percent of Maryland's air quality problem. Addressing air pollutants from neighboring states is a priority for Maryland and we are urging the United States Environmental Protection Agency (EPA) to adopt federal rules to reduce emissions from these states. We are also working with EPA and other states to use provisions in the federal *Clean Air Act* to ensure that these reductions in upwind states become effective.

Resources

Quality of Air Monthly Reports http://www.mde.state.md.us/programs/Air/AirQualityMonitoring/Pages/AQSummary.aspx

Maryland State Implementation Plans http://www.mde.state.md.us/programs/Air/AirQualityPlanning/Pages/programs/airprograms/air_planning/index.aspx

Air Monitoring Network http://www.mde.state.md.us/programs/Air/AirQualityMonitoring/Pages/Network.aspx

National Ambient Air Quality Standards http://www.epa.gov/ttn/naaqs/

Six Common Air Pollutants http://www.epa.gov/air/urbanair/

Maryland Healthy Air Act http://www.mde.maryland.gov/programs/air/pages/md_haa.aspx

Constellation Energy http://ir.constellation.com/releasedetail.cfm?ReleaseID=447838

Maryland Clean Cars Program http://www.mde.maryland.gov/programs/Air/MobileSources/CleanCars/Pages/index.aspx

NASA DiscoverAQ http://discover-aq.larc.nasa.gov/

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